

PHYSIOLOGICAL EFFECT OF MICRONUTRIENT ON YIELD AND YIELD ATTRIBUTES OF SESAME CROPS OF COASTAL ODISHA CONDITION

BARSHA BINDU ROUL¹, B. K. MISHRA² & NIBEDITA PRUSTY³

^{1,3}SRF-NRRI, Cuttack, Odisha, India

²Associate Professor, OUAT, Bhubaneswar, Odisha, India

ABSTRACT

A Research and Field Experiment was undertaken at the Department of Plant Physiology, College Of Agriculture, OUAT, Bhubaneswar in the year 2014 in order to know the Physiological Effect of Micronutrient on Yield and Yield Attributes of Sesame Crops in Coastal Odisha Climatic situation. 3 Researchers were involved in this Research to get concrete conclusion regarding this. So that farmers can use the latest technology. The research was conducted during Kharif Season. Various Micronutrient Tests had been made for getting suitable result by using AAS machine and Spectrophotometer.

KEYWORDS: Micronutrient, Physiological Effect & Yield

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INTRODUCTION

Sesame is a flowering plant and called as “Queen of all Oilseeds” In Odisha, the deficiency of micronutrients has been observed in light –textured red and lateritic acid soils. The situation has been aggravated by the introduction of high yielding crop varieties and intensive cropping system. As the demands of nutrients for the higher yields increase and plant requirements for major nutrients are only met micronutrient deficiencies are likely to become acute. In Odisha soil, the deficiency of micronutrients like Zn, B, and Mo has been reported both by farmers, extension and research workers. Low seed yield, due to deficiency of above micronutrients, have been well recognized due to several reasons such as flower and fruit drop, low harvest index and poor vegetative growth. Keeping all the above facts into consideration, the present investigation has been undertaken to study the effect of micronutrients applied as foliar spray, on metabolism, growth and yield of sesame crop.

MATERIAL AND METHODOLOGY

Randomized Block Design was used in this experiment to get the concrete results. Field Level Experiment was executed carefully under the guidance of a Plant Physiologist. The experiment was carried out in randomized block design with 10 treatments and replicated thrice. Field Level Intercultural operations were done with proper care. The application of various Micronutrients at field time to time in order to observe the real result.

The Modus Operandi of Field Preparation is as per the following Calendar prepared by the Researchers.

Calendar of Field Operation

Date	Field Preparation
11.06.2014	Collection of soil sample
14.06.2014	Ploughing
16.06.2014	application of FYM and fertilizer
17.06.2014	Lay out and leveling
18.06.2014	Sowing
19.06.2014	Irrigation
02.07.2014	2 nd irrigation
07.07.2014	Thinning
08.07.2014	Hoeing and weeding
09.07.2014	Top dressing
10.07.2014	Earthling up
12.07.2014	3 rd irrigation
22.07.2014	4 th irrigation
03.08.2014	1 st Foliar application
08.08.2014	Sampling of plant
11.08.2014	5 th irrigation
18.08.2014	2 nd Foliar application
25.08.2014	Sample collection
26.09.2014	6 th irrigation
27.09.2014	Harvesting

Sampling Techniques

Plants were sampled from a unit area of 0.30m² 5 no. of plants at random from each plot leaving sufficient border rows around it. The plant parts were separated and sun dried. Then dried in a hot air oven at 80⁰ for 72 hrs. Till constant weight. The dry weight of different plant parts was recorded.

Growth Observations

The following observations were recorded in 45, 60 and 90 DAS.

RESULTS AND DISCUSSIONS

After the Critical observation and enthusiastic Field experiment was conducted at central farm OUAT, BBSR, during Kharif 2014 with 10 treatments replicated thrice in a Randomized Block Design to study the response of sesame to foliar application of micronutrients. The morphological, physiological and biochemical observations taken at various growth stages during the course of the investigation were recorded, statistically analyzed and presented in this chapter with appropriate tables and figures in following heads and subheads.

Dry Matter Accumulation and its Partitioning

Dry matter accumulation and its partitioning into different plant parts were recorded in 45, 60, and 90 DAS were presented in table 5. Data revealed that there was a concomitant increase in total dry matter (TDM) accumulation till 90 DAS but it's partitioning to different parts like leaf, stem and pod increased up to 60 DAS but at 90 DAS partitioning of TDM was less to the leaf compared to stem and pod.

Foliar application of all the micronutrients and their combination significantly increased leaf dry matter (LDM), stem dry matter (SDM), pod dry matter (PDM) and total dry matter (TDM) of the plant recorded in 45, 60 and 90 DAS over control except foliar application of Cu (T₅), Fe (T₆) which found at par with control with respect to (TDM) and its

partitioning to different plant parts at various growth stages. Significantly the highest accumulation of dry matter in leaf, stem, pod as well as in whole plant recorded at all the growth stages in plant applied with foliar sprays of micronutrients in combination (T₉) followed by foliar application of Zn (T₃) and B (T₂). The pattern of partitioning of TDM at 45 and 60 DAS are same i.e. Stem > leaf > pod whereas the pattern of partitioning of TDM was in a sequence of pod > stem > leaf at 90 DAS.

PHYSIOLOGICAL TRAITS

LAI, SLA, SLW and LAR

Growth parameters like LAI, SLA, SLW and LAR determined at 45 and 60 DAS were presented in table-6. Data indicated that higher values of LAI and SLW were found at 60 DAS where as the higher value of SLA and LAR were noticed at 45 DAS in all the treatments.

Leaf area index (LAI) increased significantly due to foliar application of micronutrients which was ranged a minimum of 0.91 (T₁) to a maximum of 1.35 (T₉) at 45 DAS and 1.08 (T₁) to 2.24 (T₉) at 60 DAS. In both the stages (45 and 60 DAS) significantly the highest LAI was recorded in plants sprayed with combined micronutrients (T₉) followed by application of Zn (T₃), B (T₂), Mo (T₄) and commercial mixture (T₁₀).

Table.1: Effect of Different Micronutrients on Dry Matter Accumulation (g/plant) and its Partitioning

Treatments	45DAS				60 DAS				90DAS			
	LDM	SDM	PDM	TDM	LDM	SDM	PDM	TDM	LDM	SDM	PDM	TDM
T ₁	0.95	0.90	0.08	1.95	1.93	3.08	2.80	7.81	1.71	4.31	4.42	10.44
T ₂	1.51	1.68	0.32	3.52	3.27	5.50	5.50	14.27	2.95	7.01	10.27	20.23
T ₃	1.59	1.69	0.25	3.54	3.90	5.56	5.30	14.76	3.73	7.63	10.14	21.50
T ₄	1.49	1.64	0.22	3.37	3.12	4.57	4.40	12.09	2.83	5.88	8.21	16.92
T ₅	1.09	1.11	0.10	2.30	2.11	3.97	3.30	9.38	1.96	4.37	5.90	12.23
T ₆	1.27	1.23	0.11	2.62	2.67	4.13	3.50	10.30	1.77	4.79	6.59	13.15
T ₇	1.33	1.50	0.19	3.03	2.83	4.31	3.60	10.74	2.56	5.50	7.63	15.69
T ₈	1.32	1.48	0.12	2.93	2.80	4.29	3.50	10.59	2.64	5.18	7.14	14.96
T ₉	1.92	1.72	0.36	4.01	4.26	7.16	6.90	18.32	4.09	8.40	13.40	25.89
T ₁₀	1.49	1.55	0.20	3.24	2.88	4.34	4.30	11.52	2.77	5.85	7.59	16.21
SE(m) ₊	0.014	0.003	0.015	0.183	0.171	0.268	0.303	0.690	0.158	0.341	0.479	0.979
C. D(0.5)	0.04	0.008	0.04	0.54	0.50	0.79	0.90	2.05	0.47	1.01	1.42	2.90

Table 2: Effect of Different Micronutrients on Lai, SLA, SLW, LAR at Different Growth Stages

Treatments	LAI		SLA(cm ² /g)		SLW(mg/cm ²)		LAR(cm ² /g)	
	45DAS	60 DAS	45DAS	60 DAS	45DAS	60 DAS	45DAS	60 DAS
T ₁	0.91	1.08	428.8	252.8	2.33	3.95	210.4	62.4
T ₂	1.08	1.77	324.2	244.4	3.08	4.09	139.0	56.0
T ₃	1.13	2.10	319.0	243.2	3.13	4.11	143.7	64.2
T ₄	1.09	1.65	329.2	239.1	3.03	4.18	146.4	61.7
T ₅	0.98	1.33	405.0	284.3	2.46	3.51	191.6	63.9
T ₆	1.00	1.38	353.6	233.6	2.82	4.28	171.7	60.5
T ₇	1.06	1.63	360.1	259.7	2.77	3.84	158.3	68.4
T ₈	0.98	1.32	335.3	213.0	2.98	4.69	151.7	56.3
T ₉	1.35	2.24	317.3	237.4	3.15	4.21	151.9	55.2
T ₁₀	1.07	1.64	321.9	257.0	3.10	3.89	148.2	64.2
SE(m) ₊	0.052	0.053	0.641	0.606	0.082	0.001	0.475	3.382
C. D(0.5)	0.15	0.15	1.90	1.79	0.24	0.002	1.41	NS

Specific leaf area (SLA) was recorded at 45 and 60 DAS differed significantly among the treatments. At 45 DAS the highest SLA 428.8 cm²/g was recorded in the control (T₁) and lowest 317.3 cm²/g in T₉ where as at 60 DAS the SLA was highest 284.3 cm²/g in T₅ and the lowest 213 cm²/g recorded in T₈. Though significant differences in SLA was observed among the treatments in both the stages, but no definite trend in the influence of micronutrient spray on SLA was observed at both stages.

Specific leaf weight (SLW) recorded at 45 and 60 DAS differed significantly among the treatments. Foliar application of most of the micronutrients alone or in combination significantly increased SLW over control. At 45 DAS the maximum SLW 3.15 mg/cm² recorded in plants applied with foliar sprays of combined micronutrients (T₉) followed by Zn (T₃), commercial mixture (T₁₀) and B (T₂) whereas at 60 DAS, the highest SLW 4.69 mg/cm² was recorded in Co (T₈) followed by Fe (T₆) and T₉. The lowest value of SLW was recorded in the control (T₁) at 45 DAS and in Fe (T₅) at 60 DAS.

Leaf area ratio (LAR) recorded at 45 and 60 DAS varied among the treatments. The highest LAR 210.4 and the lowest 139 cm²/g were recorded in T₁ and T₂ respectively at 45 DAS. Whereas highest LAR 68.4 and lowest 55.2 cm²/g were recorded in foliar spray of Mn (T₇) and combined micronutrients (T₉) respectively at 60 DAS. Though LAR differed among the treatments recorded in both the stages, but no definite influence of micronutrient spray on LAR was observed.

RGR, NAR, CGR and LAD

- RGR, NAR, CGR and LAD determined between 45 and 60 DAS were depicted in table-7.
- Relative growth rate (RGR) increased with foliar sprays of most of the micronutrients over control, but significant, increase was recorded (101.3 mg/g/day) in combined micronutrients sprayed (T₉) followed by Zn (T₃).
- Net assimilation rate (NAR) significantly influenced by foliar application of micronutrients. The significant increase in NAR over control was observed in case of the foliar spray of all the micronutrients except Mn (T₇) which was at par with control. The highest NAR 1.2 mg/cm²/day was recorded in T₉ followed by B (T₂) and Zn (T₃).

Table 3: Effect of Different Micronutrients on RGR, NAR, CGR and LAD at Different Growth Period

Treatments	RGR(mg/gm/day)	NAR(mg/cm ² /day)	CGR(g/m ² /day)	LAD
	45-60 DAS	45-60 DAS	45-60 DAS	45-60 DAS
T ₁	92.5	0.87	8.7	14.97
T ₂	93.2	1.13	15.9	21.49
T ₃	95.0	1.05	16.6	24.31
T ₄	85.2	0.95	12.9	20.66
T ₅	93.5	0.91	10.5	17.37
T ₆	91.2	0.96	11.4	17.90
T ₇	84.4	0.85	11.4	20.24
T ₈	85.5	0.98	11.3	17.36
T ₉	101.3	1.20	21.1	27.01
T ₁₀	84.4	0.91	12.2	20.36
SE(m)±	0.763	0.001	0.760	0.596
C. D(0.5)	2.26	0.002	2.58	1.77

Crop growth rate (CGR) was significantly increased by application of different micronutrients as foliar spray. Among the treatments the maximum CGR 21.1 g/m²/day was registered in plants applied with combined micronutrients

(T₉) followed by Zn (T₃), B (T₂) and Mo (T₄). The lowest CGR was recorded in control plant (T₁) where no micronutrient was applied.

Leaf area duration (LAD) was influenced significantly by foliar application of micronutrients. Among the treatments the highest LAD 27.01 was registered in T₉ followed by application of Zn (24.31), B (21.49), and Mo (20.66). The lowest LAD was recorded in control plant without micronutrients (T₁).

CONCLUSIONS

Here the Researchers are able to get the research on the effect of micronutrient on the growth of Sesame crop and able to recommend the latest technology for poor farmers. In the present investigation, it was very clear that foliar application of different micronutrients either alone or their combination enhanced most of the morpho- physiological traits (plant height, number of branches, capsules per plant, RGR, NAR, CGR and total dry matter accumulation per plant) as well as biochemical attributes (chlorophyll content, N, P and K uptake and oil content), seed yield and yield attributes over control. Application of micronutrients in combination (T₉) excelled over the rest of the treatments in respect of seed yield and oil content. Further application of individual micronutrients like B, Zn and Mo also performed well for increasing seed yield and oil content in sesamum next to combined micronutrient treatment. Keeping in view of the above beneficial effect of micronutrient application, from the present endeavor, it was concluded that foliar spray of individual micronutrients like B, Zn, Mo, Fe, Mn, Cu and Co or their combination can be used as a supplementary application along with the normal dose of N, P and K in order to improve the productivity of oilseed crop in general and sesamum in particular.

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